PATENT SPECIFICATION

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DRAWINGS ATTACHED

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THE PATENT OFFICE LONDON

(54) IMPROVEMENTS IN OR RELATING TO RESILIENT MOUNTINGS

(71) We, CONTINENTAL GUMMI-WERKE AKTIENGESELLSCHAFT, of Postfach 169, Continental-Haus, 3000 Hannover, Germany, a German Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a resilient mounting particularly for an engine of the type comprising a rubber body which has an axial bore therethrough with an intermediate section of greater diameter than its end sections, a rigid inner sleeve of less diameter than the intermediate bore section but greater diameter than the bore end sections inserted in the bore so as to impose stress on the material of the body surrounding the bore end sections, and a rigid outer sleeve which is shorter than the intermediate bore section when in an unstressed condition and is inserted in a peripheral groove in the body between two outwardly prominent lips thereof.

Known mountings of this type have a comparatively soft spring action in the transverse direction as a result of pressure impact deformation of the rubber material which surrounds the intermediate bore section until the material abuts the inner sleeve, and then have a spring action which increases in hardness, i.e. which follows a progressively increasing characteristic curve. Moreover, impact forces acting in the opposite direction to that of the static load are mainly absorbed by tensile forces of the part of the rubber body at the opposite end to that on which the static load acts, since this end is drawn into the intermediate bore section and cannot or can only slightly absorb such forces without impact plates.

The present invention is concerned with the problem of enabling such mountings to have a desired spring characteristic in the transverse direction, while at the same time achieving favourable spring properties to cater for the impact forces acting in the opposite direction to the static load.

In accordance with the invention there is provided a mounting of the type first mentioned above, the portion of the rubber body between the lips in the axial direction in its unstressed condition being at least one third shorter in length than the length of the outer sleeve so that, on fitting of the outer sleeve, the portion of the body between the lips is stretched, the lips in the unstressed condition having substantially frusto-conical surfaces which taper inwardly towards the ends of the rubber body.

The axial stretching of the rubber body in the region of the outer sleeve has the advantage that the lips supported on the outer sleeve do not rise even with acute stresses in both directions, and thereby prevent the occurrence of friction and wear, whilst on the other hand, with stresses in the transverse direction the axially stressed rubber parts are not only subjected to pressure forces but also, according to a determined spring characteristic, partly undergo tensile stresses since the axially prestressed portions of the rubber body are supported by the lips at both ends of the inner sleeve and at least in their outer portions can only yield to the transverse stresses by further stretching. In that the region of the rubber body which is stressed by the outer sleeve lies in the central region of the rubber body, the effect produced by the axial stretching is always present, even if to achieve certain charactersic curves this stretching is in the direction of the static load or is displaced opposite thereto from the middle of the intermediate bore section towards one or the other side. The portions of the rubber body lying outside the region stressed by the outer sleeve are permanently supported in an inclined direction on the inner sleeve owing to the length of the intermediate bore section and are thereby in particular also braced against the ends of the outer sleeve with the aid of the lips, so that on compression in the transverse direction, the lips are strongly urged against the ends of the outer sleeve and with combined axial forces and transverse forces the lips are effectively pre-

vented from rising up off the outer sleeve.

According to one embodiment, a particularly advantageous step for achieving variable spring characteristics in all resilient directions exists wherein the innner sleeve is divided into two parts, one of the parts being axially slidable on a bolt secured to an engine and the parts being spaced sufficiently to allow compression of the rubber body under the static load of the engine.

The tension produced by the outer sleeve in the outer part of the rubber body is thereby maintained as before whilst the inner portions, particularly the parts surrounding the intermediate bore section, are less biased in the axial direction and under the action of the static load, i.e. after mounting the engine the end of the rubber body lying in the direction of the static load is relaxed and the opposite end of the rubber body is subjected to pressure. The mounting may also be formed so that the spacing between the parts of the inner sleeve is greater than the greatest possible spring deflection occurring in the direction of the static load. The part of the inner sleeve remote from the static load remains in the rest position with the usual compressions and slides on the screw bolt whilst a displacement of the part of the rubber body attached to the sleeve part only occurs with impact forces acting in the opposite direction to the static load.

Two preferred embodiments of the invention will now be described with reference to the accompanying drawing, in which:

Fig. 1 is a cross-sectional view of an unstressed rubber body, according to a first embodiment;

Fig. 2 shows the rubber body of Fig. 1 with outer and inner sleeves in position; and,

Fig. 3 is a cross-sectional view of a further embodiment.

A rubber body 1 for use in a resilient mounting is centrally apertured to form a bore 2 which in the central region of the body has a section 3 of greater diameter. The outer surface 4 of the rubber body extends from ends 5 and 6 with substantially the shape of truncated cones and towards the centre of the body defines two lips 7 and 8 between which is formed an annular groove 9.

As shown in Fig. 2, an inner sleeve 10 is inserted through the bore 2 stretching the ends 5 and 6 so that the diameter of the ends 5 and 6 is increased by a factor of 3/2. Next, an outer sleeve 11 is inserted in the groove 9 with stretching of the rubber body so that the distance 12 between the lips 7 and 8 is increased by at least a factor of 3/2 but the diameter of the groove 9 remains essentially the same or is only slightly reduced. Because of the stretching of the portion of the rubber body lying in the region of the outer sleeve 11, the lips 7, 8 are urged by pressure in the directions of the arrows 13, so that the reaction forces ensure a secure engagement of the lips 7, 8 with the outer sleeve 11. In order to support the lips 7, 8 on the outer sleeve 11, flanges 14 are provided, one of which is extended to form a mounting collar 15. Thus, in all cases where the lips 7, 8 are supported on flanges 14 forming part of the outer sleeve, the groove 9 should lie within the limits defined by the axial length 16 of the section 3. Otherwise under axial load, one end 5 or 6 of the rubber body could be forced below the level of the outer sleeve 11 as a result of impact deformation, thereby producing a drooping characteristic line in the central region.

Under transverse compression forces, the material surrounding the section 3 is subjected to pressure thrust and the axially stretched material directly beneath the outer sleeve 11 is subjected to tension, in addition to the tension already present due to the insertion of the outer sleeve. A weak spring action which nevertheless has a constantly rising characteristic line is thereby obtained.

The inner sleeve 10 is connected by a screw bolt 17, shown in chain-dotted lines, with an engine mounting plate 18, also shown in chain-dotted lines. Moreover a disc 19, also shown in chain-dotted lines, may be provided at the opposite end 6 of the rubber body 1. As a protection against impact forces which act in the opposite direction to the direction of the static load indicated by the arrow 20.

In order to achieve a spring characteristic in the direction of the static load which is as far as possible free from any tensile stress present at the end 6, the inner sleeve 10 may be divided into two short parts as shown in Figure 3. The spacing 21 between the parts of the sleeve 10 is preferably sufficient to allow compression of the rubber body 1 under the action of the static load. The rubber body 1 is thus axially displaced under the static load sufficiently in the direction of the arrow 20 for the end 6 to be substantially free from tension, or to be free from tension under a further applied loading.

In order to reduce any shocks produced during fitting of the parts of the sleeve 10 or the bolt 17 the section 3 is provided with an annular rib 22 (Fig. 3).

The axial spring characteristics may be modified by varying the shape of the body surface 4 in the region of the lips 7, 8. However, it is essential that the shape as mentioned is substantially frusto-conical.

The rubber body and the sleeves need not necessarily be circular in a plane perpendicular to the direction 20, but may be, for example, elliptical, in order to produce different characteristic lines in different transverse directions.

WHAT WE CLAIM IS:—

1. A resilient mounting comprising a rubber body which has an axial bore therethrough with an intermediate section of greater diameter than its end section, a rigid inner sleeve of less diameter than the intermediate bore section but greater diameter than the bore end sections inserted in the bore so as to impose stress on the material of the body surrounding the bore end sections, and a rigid outer sleeve which is shorter than the intermediate bore section and is inserted in a peripheral groove in the body between two outwardly prominent lips thereof, the portion of the rubber body between the lips in the axial direction in an unstressed condition being at least one third shorter in length than the length of the outer sleeve so that, on fitting of the outer sleeve, the portion of the body between the lips is stretched, the lips in the unstressed condition having substantially frusto-conical surfaces which taper inwardly towards the ends of the rubber body.

2. A mounting according to claim 1, in which the inner sleeve is divided into two parts which are spaced apart whereby a portion of the intermediate bore section does not have a sleeve therein.

3. A resilient mounting substantially as hereinbefore described with reference to Figs. 1 and 2 of Fig. 3 of the accompanying drawings.

4. An engine having a resilient mounting as claimed in any preceding claim, the engine having a bolt which passes through the inner sleeve.

5. An engine as claimed in claim 5 when dependent on claim 3, in which one of the parts is slidable on the bolt and the parts are spaced sufficiently to allow compression of the rubber body under the action of the static load of the engine.

6. An engine including a resilient mounting as claimed in claim 5, in which the slidable part is that part remote from the engine.

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1289746 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

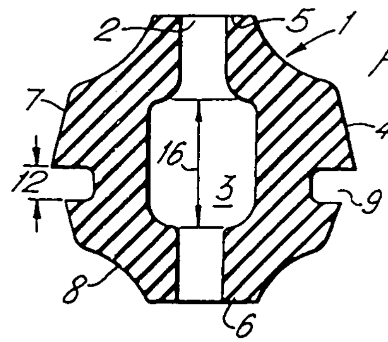

Fig. 1.

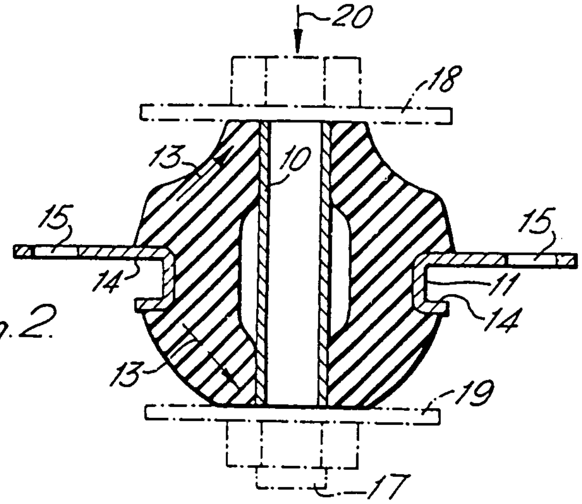

Fig. 2.

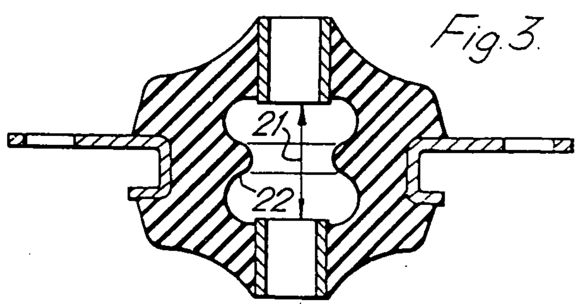

Fig. 3.